

TECHNICAL BRIEF – TRUSS IMPLANT TECHNOLOGY EVALUATION OF EXPULSION PERFORMANCE, ANTERIOR SPINE TRUSS SYSTEM

QUICK FACTS

- The 4WEB 12° lordotic ASTS implants were tested against retrograde expulsion forces
- The implants had an average expulsion force greater than reported for disc shear tolerances and allograft spacers
- The average retrograde expulsion force was greater than those reported for other intervertebral fusion devices
- When used with supplemental fixation, as indicated, the 4WEB ASTS implants makes the risk of expulsion negligible

Expulsion testing performed by Lisa Ferrara, Ph.D. OrthoKinetic Testing, LLC

PURPOSE

To characterize the expulsion performance of the 4WEB® Anterior Spine Truss System (ASTS).

METHODS

Expulsion testing was performed to determine the maximum load required for retrograde expulsion from a lumbar disc space.

ASTS APPARATUS AND LOAD PROTOCOL

12° Lordotic Angle

- Small Footprint 32mm x 21mm
- Large Footprint 40mm x 27mm

Test Fixture Apparatus and Load Protocol

- Grade 15 solid rigid polyurethane foam blocks were used to simulate vertebral bodies.
- Applied 500N
 1. Along the Z-axis of the device.
 2. Perpendicular to the Z-axis
- Force was applied at a rate of 25mm/minute.
- The force required to cause loss of fixation and dislodge the device from the foam was recorded.

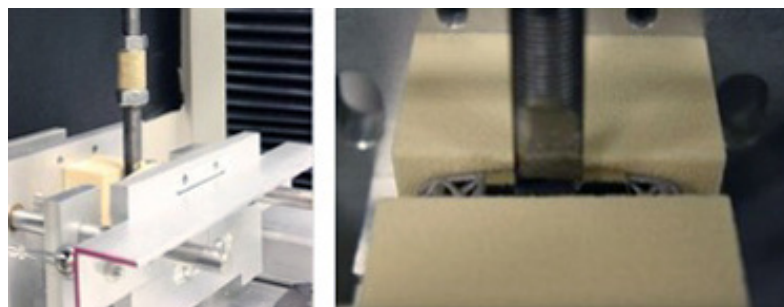


Figure 1: Images of the expulsion test apparatus.

RESULTS

The average results of multiple expulsion tests for each of the two ASTS implant footprints are represented graphically below.

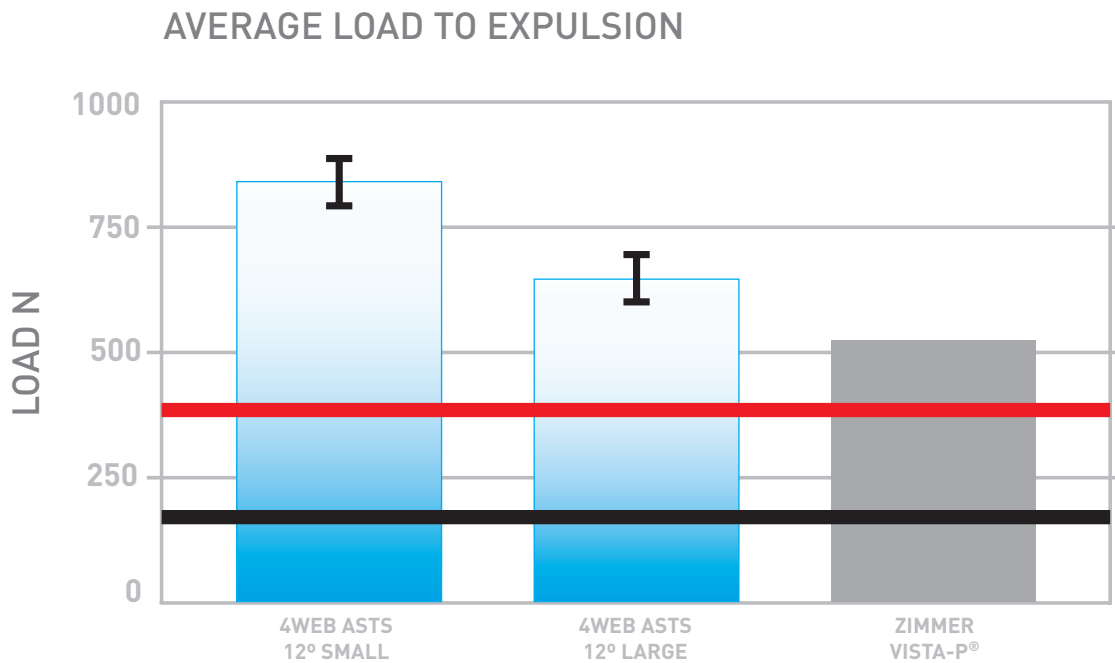


Figure 2: A) Average expulsion force (\pm SD) of results for the ASTS small and large implant footprints.
 B) The red line represents the reported maximum shear force for allograft spacers.
 C) The black line represents the reported maximum *in-vivo* intervertebral disc shear force.

SUMMARY

The maximum shear force an intervertebral disc can withstand is approximately 150N to 200N.¹⁻⁵ The 4WEB ASTS implants had minimum expulsion forces greater than intervertebral disc shear tolerances, allograft spacers (between approximately 230N to 405N)¹⁻⁵ and the Zimmer Vista-P® (Zimmer, Warsaw, IN).^{3,4} The 4WEB Anterior Spine Truss System minimizes the risk for expulsion.

REFERENCES:

- 1) White A, Panjabi MM: Clinical biomechanics of the spine, 2nd edition, JB Lippincott Co. Philadelphia, PA 1990.
- 2) Rapoff, AJ, Ghanayem, AJ, Zdeblick, TA: Biomechanical comparison of posterior lumbar interbody fusion cages. Spine 1997 Oct 15;22(20):2375-9.
- 3) Janssen ME, Nguyen C, Beckham R, Larson A: Biological Cages, Eur Spine J. 2000, 9 (Suppl 1): S102
- 4) Janssen ME, Lam C, Beckham R, Outcomes of allogenic cages in anterior and posterior lumbar interbody fusion, Eur Spine J, 10:S158-168, 2001.
- 5) Lu WW, Luk KD, Holmes AD, Cheung KM, Leong CY. Pure shear properties of lumbar spinal joints and the effect of tissue sectioning on load sharing. Spine Vol. 30, No. 8, pp: E204-E209, 2005.